**3GPP TSG-RAN WG4 Meeting #94-e R4-20xxxxx**

**Electronic Meeting, Feb.24th – Mar.6th 2020**

**Agenda item:** 6.12

**Source:** Moderator (Intel Corporation)

**Title:** Email discussion summary for RAN4#94e\_#89\_NR\_NewRAT\_Demod

**Document for:** Information

# Introduction

Definition of Rel-15 UE and BS NR demodulation requirements were finalized in RAN4 #93 meeting. The scope of this email thread is:

* Collect comments for CRs which contain corrections for Rel-15 requirements defined in TSs 38.101-4, 38.104, 38.141-1 and 38.141-2
* Discuss topics related to corrections/clarifications of Rel-15 requirements.

Email discussion targets for the 1st round and 2nd round

* 1st round:
  + Discuss proposals related to corrections/clarifications of Rel-15 requirements.
  + Collect comments for CRs which contain editorial corrections.
* 2nd round:
  + Collect comments for revised CRs from the 1st round.
  + Collect comments for CRs with changes related to agreements for open issues from Sections 1.2 and 2.2.
  + Collect comments for WFs (if needed)

# Topic #1: UE demodulation and CSI requirements

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000076 | ANRITSU LTD | CR with the following changes for TS 38.101-4:   * Clarify “Precoding configuration” in Table 5.2-1 for PDSCH requirements. * Clarify “Precoding configuration” in Table 5.3-1 for PDCCH requirements. * In the PMI general description 6.3, clarify PDSCH random precoding. * In each PMI scenario, clarify Note 1 on Precoding configuration in Tables 6.3.2.x and 6.3.3.x. |
| R4-2000081 | ANRITSU LTD | CR with the following changes for TS 38.101-4:   * Table 5.3.3.1.2-1 Test 3 : Aggregation level is changed from 4 to 8 * Table 5.3.3.2-1 : Interleaversize=3 is specified (Aligned with corresponding 2RX TDD 2Tx test) * Table B.2.3.2.2-1: Typo corrected. |
| R4-2000353 | Qualcomm Incorporated | CR with the following changes for TS 38.101-4:   * Test cases for FR1 TDD Rank2 in Table 5.2.3.2.1-4 are corrected. * Precoding is specified for PDCCH in PDSCH test cases * Channel matrix is specified for HST single tap test cases |
| R4-2000358 | Intel Corporation | CR with the following changes for TS 38.101-4:   * Updated ‘pattern1’ and ‘pattern2’ parameter fields in tables with TDD configurations * Modified title for section A.1.3 from “TDD UL-DL configuration for FR2” to “TDD UL-DL configurations for FR2” to align with title naming for FR1 * Corrected unit for “Number of Code Blocks” in E-UTRA FRC tables * Removed row with “Maximum number of HARQ transmissions” configuration from several TDD FRC tables * Added missing units in Table A.3.2.2.2-8 * Aligned formatting for several rows in tables A.3.2.2.2-8 and A.3.2.2.5-8 |
| R4-2000564 | Rohde & Schwarz | **Proposal 1:** The SS-Block is mapped to one single physical antenna at Ref.1 as long as no beamforming is applied.  **Proposal 2:** Update the specification to include Table 3‑1 with the relevant information for each requirement with regard to Ref. 1.   |  |  |  |  | | --- | --- | --- | --- | | **Parameter** | **Unit** | **Value before applying channel matrix** | **Mapping to antenna before applying channel matrix** | | SSS transmit power | W | Test specific |  | | EPRE ratio of PSS to SSS | dB | 0 | PBCH transmitted over Single antenna | | EPRE ratio of PBCH to SSS | dB | 0 | | EPRE ratio of PBCH to PBCH DMRS | dB | 0 | | EPRE ratio of PDCCH to SSS | dB | 0 | PDCCH transmitted over same antenna as PBCH | | EPRE ratio of PDCCH to PDCCH DMRS | dB | 0 | | EPRE ratio of PDSCH DMRS to SSS | dB | Test specific | TC specific | | EPRE ratio of PDSCH to PDSCH DMRS | dB | Test specific (Note 1) | | EPRE ratio of CSI-RS to SSS | dB | Test specific (Note 2) | TC specific | | EPRE ratio of PDSCH OCNG to SSS | dB | Test specific (Note 3) | TC specific | | EPRE ratio of PDCCH OCNG to SSS | dB | 0 | Transmitted over same antenna as PBCH | | NOTE 1: Value is derived from Table 4.1-1 in TS 38.214 [12] based on “Number of DM-RS CDM groups without data” and “DMRS Type” parameters specified for each test.  NOTE 2: CSI-RS is not beamformed. Therefore in case of beamforming in general it will experience a gain from the channel matrix H which is different to the gain that a beamformed channel/signal will experience.  NOTE 3: NOTE 3: Since OCNG on different transmit antennas is always uncorrelated according to Annex A.5 it in general will experience a different power gain from the channel matrix H than PDSCH. This is because PDSCH on different transmit antennas might be correlated, e.g. in case of beamforming or Tx diversity. | | | |   Table 3‑1: Table proposed from R&S  **Proposal 3:** Add precoding matrix for PDSCH to each requirement to clarify mapping of antenna ports to physical antennas. |
| R4-2000565 | Rohde & Schwarz | CR with the following changes for TS 38.101-4:   * Updated tables C.3.1-1 and C.5.1-1. |
| R4-2001002 | MediaTek inc. | CR with the following changes for TS 38.101-4:   * In that test case, change the number of NZP CSI-RS ports from 2 to 4, in order to align with the antenna configuration ULA Low 4x4 |
| R4-2001450 | Huawei, HiSilicon | CR with the following changes for TS 38.101-4:   * Added the number of HARQ process 10 for 4Rx PDSCH Test 1-9 in Table 5.2.3.2.1-2; * Removed the left half square brackets. |

## Open issues summary

**Issue 1-1: SS-Block mapping to physical antennas**

* Background/Current status:
  + Rel-15 PBCH requirements are defined for scenarios with one Tx antenna
  + Mapping of SSS/PSS/PBCH to physical antennas is not specified for scenarios with number of Tx antenna higher than one.
* Proposals
  + Option 1: The SS-Block is mapped to one single physical antenna (R&S)
* Recommended WF
  + Collect companies views on option above.

**Issue 1-2: PDCCH mapping to physical antennas**

* Background/Current status:
  + Rel-15 PDCCH requirements are defined for the following precoding configuration: SP Type I, Random per slot with REG bundling granularity for number of Tx larger than 1.
  + PDCCH precoding configuration is not defined for PDSCH, SDR and CSI requirements.
* Proposals
  + Option 1: The PDCCH is mapped to one single physical antenna (R&S)
  + Option 2: Use precoding configuration from Rel-15 PDCCH requirements for PDSCH tests (QC)
* Recommended WF
  + Discuss whether we need to use Option 1 or Option 2 for PDSCH tests.
  + Discuss PDCCH precoding configuration for SDR and CSI tests
    - Note: For PDCCH we cannot modify previously agreed procedure for mapping to physical antennas, because it may lead to shit of SNR point.

**Issue 1-3: PDSCH mapping to physical antennas**

* Background/Current status:
  + PDSCH precoding granularity from Tables 5.2-1 and 7.2-1
    - FR1: SP Type I, Random per slot with PRB bundling granularity
    - FR2: SP Type I, Random per slot with Wideband granularity
  + Beamforming model is described in B.4.1.
* Proposals
  + Option 1: Add precoding matrix for PDSCH to each requirement to clarify mapping of antenna ports to physical antennas. (R&S)
* Recommended WF
  + Discuss whether we need to make additional clarifications in the existing PDSCH mapping procedure.

**Issue 1-4: DL channel signal power ratios**

* Background/Current status:
  + Power configurations for PDSCH, PDSCH DMRS, CSI-RS and OCNG are defined as

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| EPRE ratio of PDSCH to SSS | dB | 0 |
| EPRE ratio of PDSCH to PDSCH DMRS | dB | Test specific (Note 1) |
| EPRE ratio of CSI-RS to SSS | dB | 0 |
| EPRE ratio of OCNG to SSS | dB | 0 |
| Note 1: Value is derived from Table 4.1-1 in TS 38.214 [12] based on "Number of DM-RS CDM groups without data" and "DMRS Type" parameters specified for each test | | |

* Proposals
  + Option 1: Make the following modifications in configuration DL channel signal power ratios (R&S)

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| --- | --- | --- |
| **Parameter** | **Unit** | **Value before applying channel matrix** |
| EPRE ratio of PDSCH DMRS to SSS | dB | Test specific |
| EPRE ratio of PDSCH to PDSCH DMRS | dB | Test specific (Note 1) |
| EPRE ratio of CSI-RS to SSS | dB | Test specific (Note 2) |
| EPRE ratio of PDSCH OCNG to SSS | dB | Test specific (Note 3) |
| EPRE ratio of PDCCH OCNG to SSS | dB | 0 |
| NOTE 1: Value is derived from Table 4.1-1 in TS 38.214 [12] based on “Number of DM-RS CDM groups without data” and “DMRS Type” parameters specified for each test.  NOTE 2: CSI-RS is not beamformed. Therefore in case of beamforming in general it will experience a gain from the channel matrix H which is different to the gain that a beamformed channel/signal will experience.  NOTE 3: Since OCNG on different transmit antennas is always uncorrelated according to Annex A.5 it in general will experience a different power gain from the channel matrix H than PDSCH. This is because PDSCH on different transmit antennas might be correlated, e.g. in case of beamforming or Tx diversity. | | |

* Recommended WF
  + Discuss whether existing configuration leads to issue with different EPRE ratio of Phy channels / Reference signals before and after applying of channel matrix.

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| Qualcomm | Issue 1-1: Ok with Option 1 for PBCH requirements. However, we don’t understand why we need to clarify this since there is only 1 antenna configured in the test. We didn’t have to clarify this for PDCCH tests. What is so special in this case?  Issue 1-2: We prefer Option 2 to avoid any SNR issue with PDCCH decoding.  Issue 1-3: We are not sure why additional clarification is needed here based on our understanding in Issue 1-4.  Issue 1-4: In our opinion, after applying the channel matrix, signal should be normalized. So this issue of 6dB power difference in case of 4 ports should not happen. So, we should not modify this table. |
| Company B | Issue 1-1:  Issue 1-2:  Issue 1-3:  Issue 1-4: |

### CRs comments collection

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| **CR number** | **Comments collection** |
| R4-2000076 | Ericsson: Need to align with Qualcomm CR (R4-2000353), otherwise should be fine. |
| Qualcomm: In Table 5.3-1, we should still keep “with REG bundling granularity for number of Tx larger than 1.” at the end apart from the clarification added. |
|  |
| R4-2000081 | Ericsson: That is not a typo, should be different aggregation levels for 2Rx, and 4Rx. See R4-1902406. |
| Qualcomm: For change in Table 5.3.3.1.2-1, based on agreed simulation assumptions, it should be Aggregation level 4. If reference channel is not correct, it should be corrected accordingly. |
| Huawei: As per the approved WF for NR PDCCH R4-1902406, AL for case#13: 8 for 2Rx and 4 for 4Rx, so the updates to Table 5.3.3.1.2-1 Test 3 : Aggregation level is changed from 4 to 8 is not needed. |
| R4-2000353 | Ericsson: Using wrong font, should be Arial, not Times New Roman for Table 5.5A-1 Also need to align with Anritsu CR (R42000076) for wording preference. |
| Huawei: It is not necessary to give further clarification about the static channel for HST single tap related test cases, the existing propagation conditions of HST-750 and HST-1000 are clear enough. |
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| R4-2000358 | Qualcomm: Looks ok. |
| Huawei:  - As per TS 38.331, pattern1 is mandatory and pattern2 is optional, so option2 is not needed to be specified for DCI-based dynamic UL/DL detection configuration like did in Table A.1.2-1;  - Note 4 in Table A.1.2-2a and Table A.1.3-2a for dynamic UL/DL detection needs to be udpated *tdd-UL-DL-semi-statically* -> *tdd-UL-DL-ConfigurationCommon*  *-* No unit is needed for “Number of Code Blocks”, just remove the current unit of “Bits” |
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| R4-2001002 | Qualcomm: Looks ok. |
| Company B |
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| R4-2001450 | Qualcomm: Looks ok. |
| Company B |
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## Summary for 1st round

### Open issues

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|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs

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| **CR number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: BS demodulation requirements

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000295 | Samsung | CR with the following changes for TS 38.141-1:   * Missing CSI part 2 in section 8.2.3.1 * Space missing in section 8.2.3.1 * Fix the typos in section 8.2.3.1 |
| R4-2000297 | Samsung | CR with the following changes for TS 38.141-2:   * Space missing in section 8.2.3.1 * Fix the spelling typos in section 8.2.3.4.2, Space missing in section 8.2.3.4.2 * Fix the spelling typos in section 8.2.3.5.2 and FRC table index |
| R4-2001172 | Ericsson | CR with the following changes for TS 38.104:   * Intra-slot frequency hopping parameter is set to N/A when there’s only 1 OFDM symbol allocated for short PUCCH (format 0 and format 2). |
| R4-2001174 | Ericsson | CR with the following changes for TS 38.141-1:   * Intra-slot frequency hopping parameter is set to N/A when there’s only 1 OFDM symbol allocated for short PUCCH (format 0 and format 2). |
| R4-2001176 | Ericsson | CR with the following changes for TS 38.141-2:   * Intra-slot frequency hopping parameter is set to N/A when there’s only 1 OFDM symbol allocated for short PUCCH (format 0 and format 2). |
| [R4-2001451](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2001451.zip) | Huawei, HiSilicon | **Observation 1:** No specific HARQ timing defined for NR BS demodulation performance tests  **Proposal 1:** Perform the NR BS demodulation conformance testing as following:   * TE firstly generates a fixed data sequence with 0, 1 symbol as per the payload size defined in the FRC for each test   **Option 1:**   * BS schedules the PUSCH transmission in a fixed periodicity, such as 5ms, by only indicating different RV sequence {0,2,3,1} to TE every time; * TE passively transmits the data with the correct RV in the following first available UL slot after TE receives the scheduling from BS, otherwise * TE should stop to transmit any data and just wait for the scheduling for PUSCH data transmission   **Option 2:**   * BS schedules the PUSCH transmission in any available DL slots before the following first available UL slots with one HARQ process, only schedule the first UL slot if more than one consecutive UL slots * TE passively transmits the data with the correct RV in the following first available UL slot after TE receives the scheduling from BS, otherwise * TE should stop to transmit any data and just wait for the scheduling for PUSCH data transmission |

## Open issues summary

**Issue 2-1: NR BS demodulation conformance testing**

* Background/Current status:
  + No specific HARQ timing defined for NR BS demodulation performance tests and definition of HARQ procedure for conformance testing is required.
* Proposals
  + Option 1 (HW):
    - TE firstly generates a fixed data sequence with 0, 1 symbol as per the payload size defined in the FRC for each test
    - BS schedules the PUSCH transmission in a fixed periodicity, such as 5ms, by only indicating different RV sequence {0,2,3,1} to TE every time;
    - TE passively transmits the data with the correct RV in the following first available UL slot after TE receives the scheduling from BS, otherwise
    - TE should stop to transmit any data and just wait for the scheduling for PUSCH data transmission
  + Option 2 (HW):
    - TE firstly generates a fixed data sequence with 0, 1 symbol as per the payload size defined in the FRC for each test
    - BS schedules the PUSCH transmission in any available DL slots before the following first available UL slots with one HARQ process, only schedule the first UL slot if more than one consecutive UL slots
    - TE passively transmits the data with the correct RV in the following first available UL slot after TE receives the scheduling from BS, otherwise
    - TE should stop to transmit any data and just wait for the scheduling for PUSCH data transmission
* Recommended WF
  + Collect companies views on options above. Identify if there any other options for this issue.

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| Keysight | Issue 2-1: We don’t believe this much detail is not necessary defined in conformance test procedure. It’s too much detail to be described. We should leave this level of detail for each individual implementation. LTE spec doesn’t have this much detail in procedure.  Regarding with number of HARQ processes, if it’s the case that this still needs to be defined, then it should be more than one whenever more processes possible to fill all UL slots in some cases like FDD. |
| Nokia, Nokia Shanghai Bell | Issue 2-1: Nokia does not think that capturing more detail is needed in the specification to allow for reproducible and consistent testing. Hence, we propose option 3: No change. Currently the HARQ feedback is provided to the TE via an error free side link (See e.g., 38.141-1 D.5.1). Since the TDD/FDD pattern is known, the TE applies RV feedback received in a test implementation specific timing window to the corresponding TB. No further information and specification is required. We assume that each TB and its retransmission contain the same payload. The payload per TB is randomized. |
| Ericsson | We checked some time ago and did not find any performance differences relating to HARQ timing. We agree that the test can be implemented with the level of detail currently provided by the specification and do not see a need to add anything new. |
| Huawei | NR is asynchronous system that is different from LTE, we agree that no performance difference relating to HARQ timing, but the test methodology between gNB and TE may be different for different TE vendors and gNB needs to cate for different test method with different TEs that increase the test cost, also different gNB has different test methods. |

### CRs comments collection

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| **CR number** | **Comments collection** |
| R4-2000295 | Nokia, Nokia Shanghai Bell:  It was Nokia’s understanding that non-essential corrections are no longer allowed for Rel-15. While the typos corrected in this CR are sometimes close to obscuring meaning, the spec should still be unambiguous for the specialist reader. Hence, only the R16 version of this CR should be agreeable.  For the R15 version, the opinion of MCC would need to be obtained. |
| Company B |
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| R4-2000297 | Nokia, Nokia Shanghai Bell: Same as for R4-2000295. |
| Company B |
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| R4-2001172 | Nokia, Nokia Shanghai Bell:  The contradiction in RRC configuration, treated by this CR, is currently being addressed in RAN2 directly (see for example R2-2000166). RAN4 should wait for the outcome of RAN2 and, in particular, should not capture assumptions in the specification that might be contradicted by expected bugfixes in RAN2.  As a side note: The configuration chosen by RAN4 is a valid R15 RRC configuration, hence the UE must be able to deal with it and not RRC rejection is allowed. |
| Ericsson: The rationale here is that currently the test configuration states in some places that both 1 symbol and frequency hopping is enabled. We see this as an error because there is an ambiguity as to whether what is meant is (i) do 2 symbols and hopping or (ii) do not do hopping.  Presumably even if the RRC configuration is valid, it is not clear how the UE deals with it right now. If RAN2 makes the fix, then it may be possible to read the test spec, read the RAN2 spec and deduce what is the expected configuration (although that would break the principle of test specs being self-contained). Our understanding is that the intention in the RAN4 spec is anyhow to configure 1 slot and no hopping as opposed to configure both 1 slot and hopping and then rely on the RAN2 behavior. |
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| R4-2001174 | Nokia, Nokia Shanghai Bell: Same as for R4-2001172. |
| Company B |
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| R4-2001176 | Nokia, Nokia Shanghai Bell: Same as for R4-2001172. |
| Company B |
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## Summary for 1st round

### Open issues

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|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs

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| **CR number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

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| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |